



American Water Works
Association

Sodium Hypochlorite Operating Experiences


Jim Van De Wege

Holland Water Treatment

Bob Veneklasen

Muskegon Water Treatment Plant

Objectives

1. Water treatment plants & process needs
 2. Evolution of the disinfection process
 3. System design from an operating perspective
 4. Operational challenges
 5. Lessons Learned
- 
- A large, faint, light blue graphic of a water droplet falling into a pool of water, creating concentric ripples, is centered in the background of the slide.

SW Shores of Lake Michigan



Holland Water Treatment Plant

- 💧 38.5 MGD conventional treatment plant
- 💧 Chemical addition, mixing, flocculation, sedimentation, filtration
- 💧 Process chemicals: aluminum sulfate, liquid fluoride & sodium hypochlorite

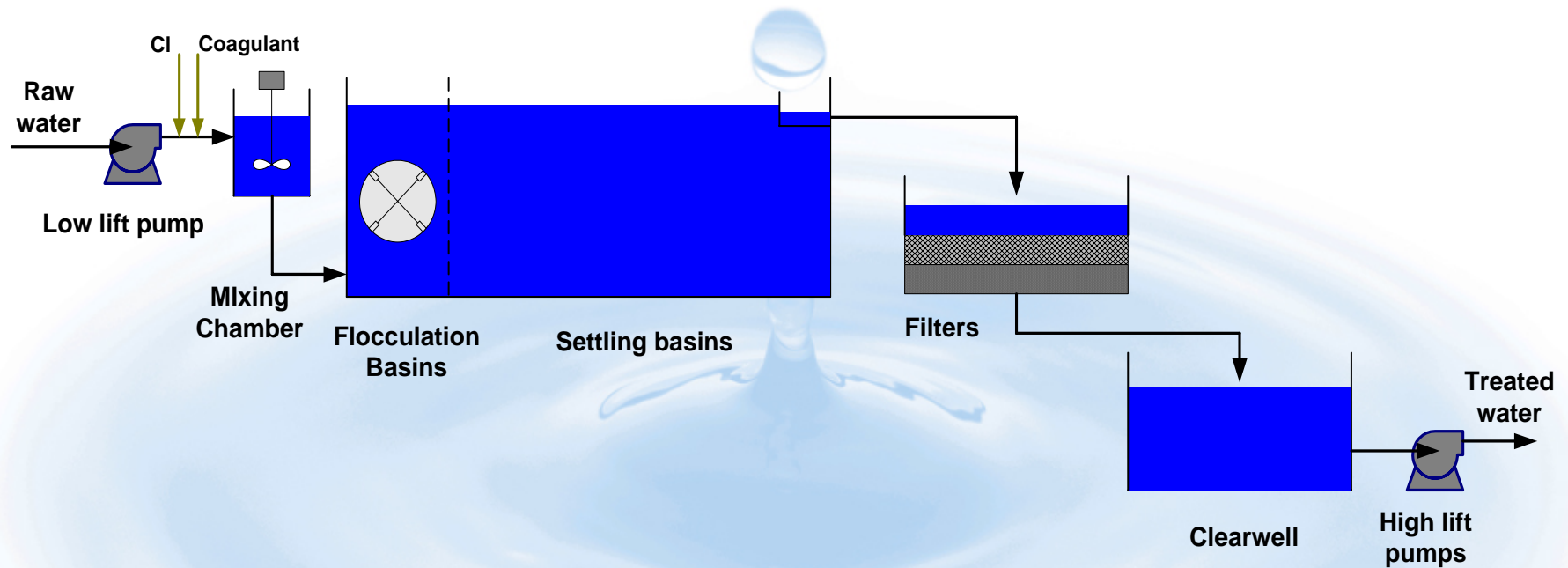


Muskegon Water Treatment Plant

- 💧 40 MGD conventional treatment plant
- 💧 Chemical addition, mixing, flocculation, sedimentation, filtration
- 💧 Process chemicals: aluminum sulfate, liquid fluoride & sodium hypochlorite



Process Diagram



Evolution of Disinfection Process

- 💧 Liquid chlorine hazardous and difficult to handle
- 💧 PSM, Hazmat Training-Expensive!
- 💧 Emergency response equipment-Expensive!
- 💧 Tested chlorine tablets, sodium hypochlorite
- 💧 Selected sodium hypochlorite
- 💧 Holland, Muskegon, & Traverse City first in area to convert to sodium hypochlorite


Evolution of Disinfection Process

A high-speed photograph of a water droplet falling into a pool of water. The droplet is captured mid-fall, just above the point of impact. Below it, a small splash is visible, with a central column of water rising and ripples spreading outwards. The background is a soft, out-of-focus blue and white, suggesting a bright, reflective surface.

Why Sodium Hypochlorite?

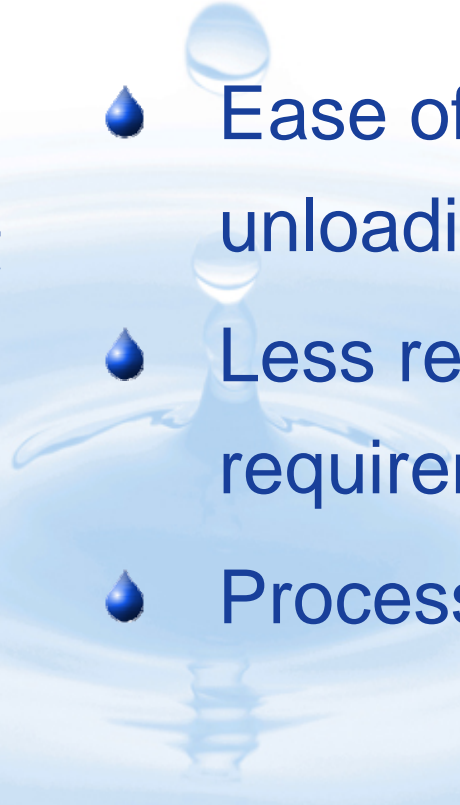
Evolution of Disinfection Process

Safety Concerns

- 
- A large, faint background image of a water splash with concentric ripples and a central droplet, serving as a visual backdrop for the text.
- 💧 Employees
 - 💧 Residential area
 - 💧 Nearby schools
 - 💧 Heavy recreational use during summer-parks & beaches
 - 💧 Bordered by bike paths
 - 💧 Slow initial emergency response

Evolution of Disinfection Process

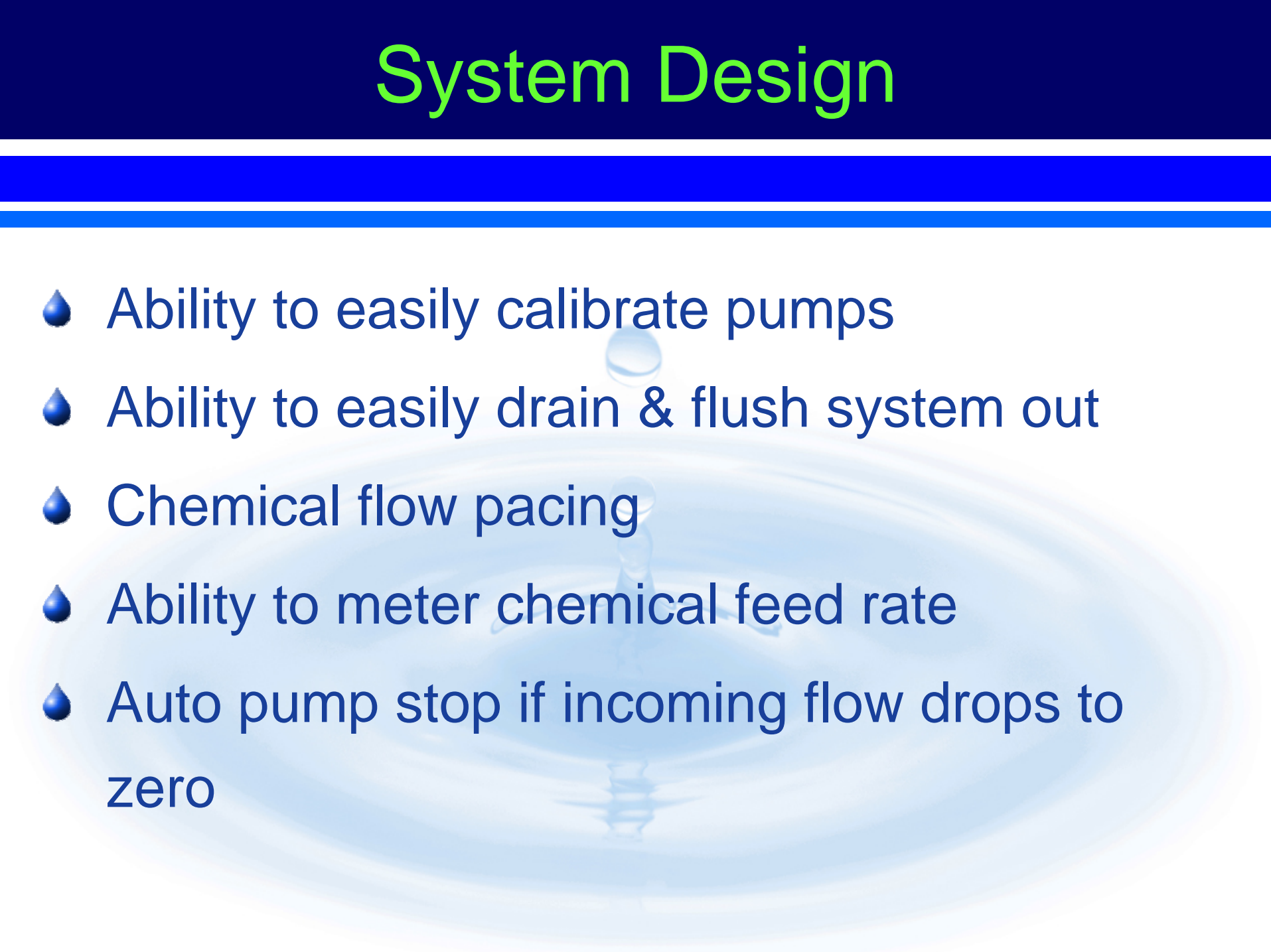
Advantages of Sodium Hypochlorite

- 
- Simplified PSM
 - Minimal Hazmat training
 - No scrubbers
 - No more ton cylinders
 - Ease of off loading or unloading
 - Less reporting requirements
 - Process Stability

System Design

- 💧 Ability to meter off loading
- 💧 Ability to dilute bulk deliveries
- 💧 Proper pump sizing-size matters
- 💧 Easy access to controls
- 💧 Input/Outputs for SCADA control, monitoring & alarming

System Design

- 
- 💧 Ability to easily calibrate pumps
 - 💧 Ability to easily drain & flush system out
 - 💧 Chemical flow pacing
 - 💧 Ability to meter chemical feed rate
 - 💧 Auto pump stop if incoming flow drops to zero

System Design

- 💧 Easy access for maintenance-preventive/reactive
- 💧 Chemical tank monitoring-consider scales for day tank monitoring
- 💧 Improved chemical containment facilities
- 💧 Safety showers & eye wash stations

System Design

Sodium Hypochlorite Feed System




System Design

Chemical Day Tanks



Operational Challenges

- 
- A large, faint background image of a water droplet hitting a surface, creating ripples and a central splash, is centered behind the text.
- 💧 Off gassing-air bound pumps
 - 💧 Gasket failures
 - 💧 Burping
 - 💧 Product stability-storage
 - 💧 Valve failures, binding
 - 💧 Bleaching of clothing

Operational Challenges



💧 Leaking joints and fittings

Operational Challenges



💧 **Corrosion of equipment**



💧 **Scaling-pipes, meters, pumps**

Operational Challenges



💧 Coating failures

Operational Challenges

Case Study-Holland

- 💧 Date: July 21, 1998: Chemical mixing incident
- 💧 Contractors on-site completing 10 MGD plant expansion
- 💧 Tanker delivery of aluminum sulfate scheduled for morning delivery
- 💧 Chemical pumped to third floor storage tank

Operational Challenges

Case Study

- 💧 Delivery sodium hypochlorite, not alum!
- 💧 Chlorine gas vented when 256 gal of sodium hypochlorite reacted with 400 gal of alum



Operational Challenges

Chlorine Gas Damaged Equipment



Unwanted Headline



Chemical spill sends 8 to hospital!

Tuesday, July 21, 1998

By Kristen Appleyard

Staff writer, Holland Sentinel

Operational Challenges

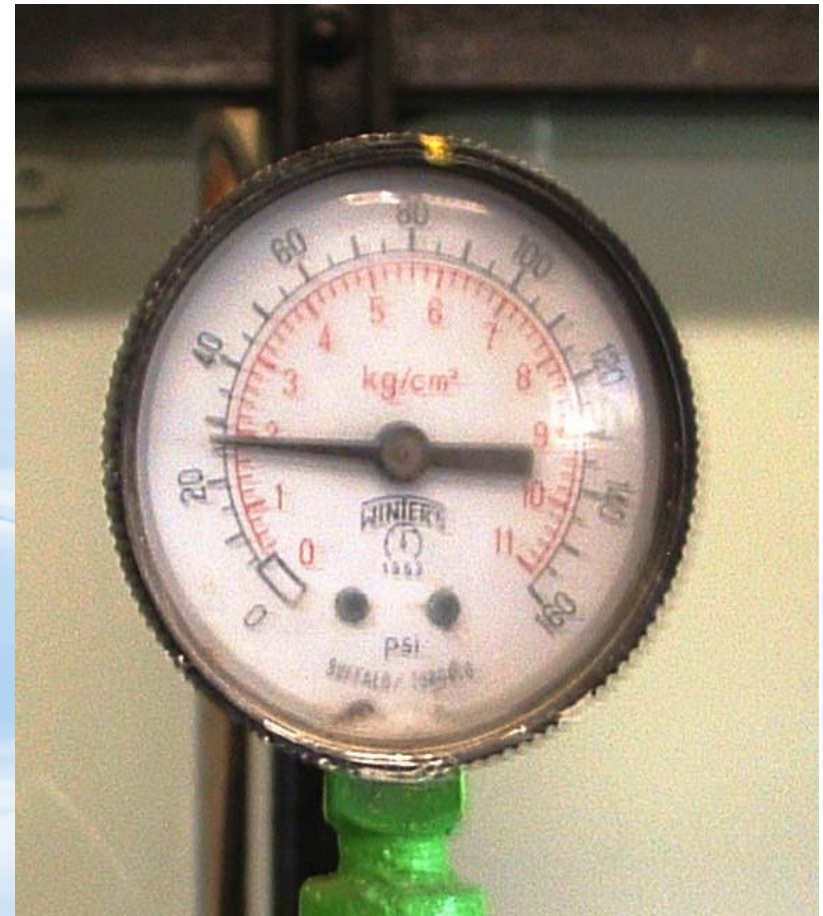
What chemicals could be a problem when mixed with sodium hypochlorite?

- Ferric Chloride
- Fluosilicic Acid (Hydrofluosilicic Acid)
- Alum (Aluminum Sulfate)


Operational Challenges

Case Study-Muskegon

- 💧 Carrier water not treated initially
- 💧 Lines became blocked
- 💧 Pressure increased
- 💧 Flow decreased



Lessons Learned

- 
- 💧 Daily inspections
 - 💧 Exercise valves
 - 💧 Preventive Maintenance
 - 💧 Proper use of PPE
 - 💧 Strainers on pump supply
 - 💧 Improved HVAC systems in chemical storage areas

Lessons Learned

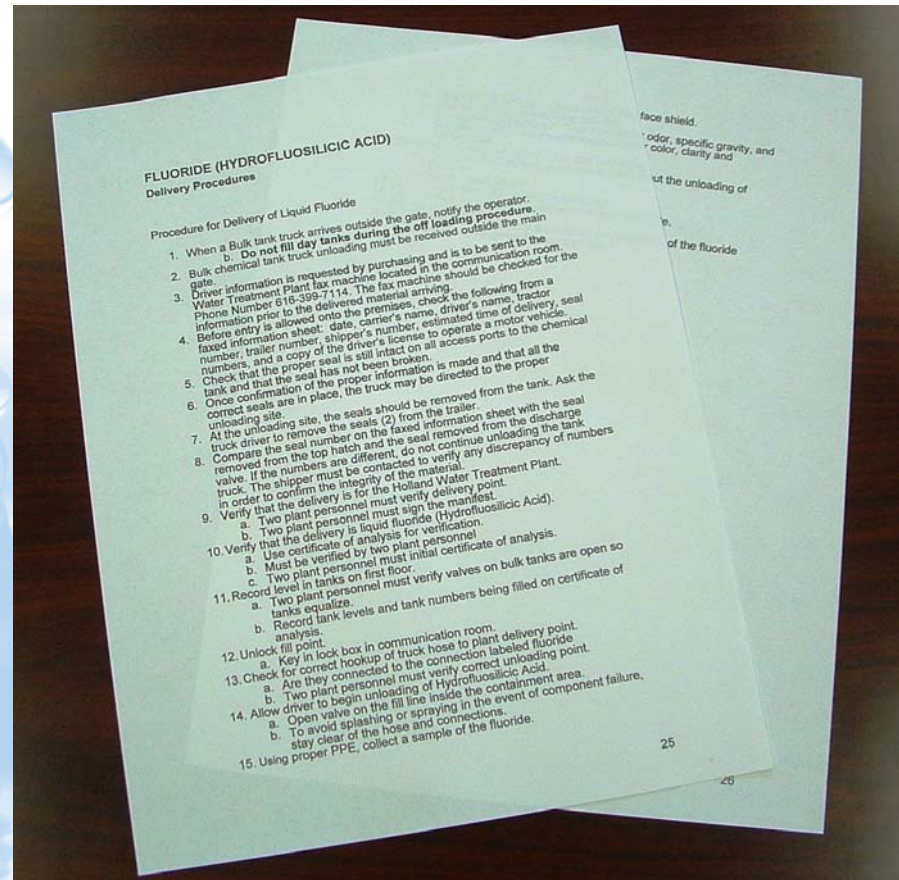


- 💧 Improved Alarming
- 💧 Improved inventory control
- 💧 Improved Labeling

Lessons Learned

💧 Detailed chemical delivery procedures

💧 Delivery check off lists



Lessons Learned

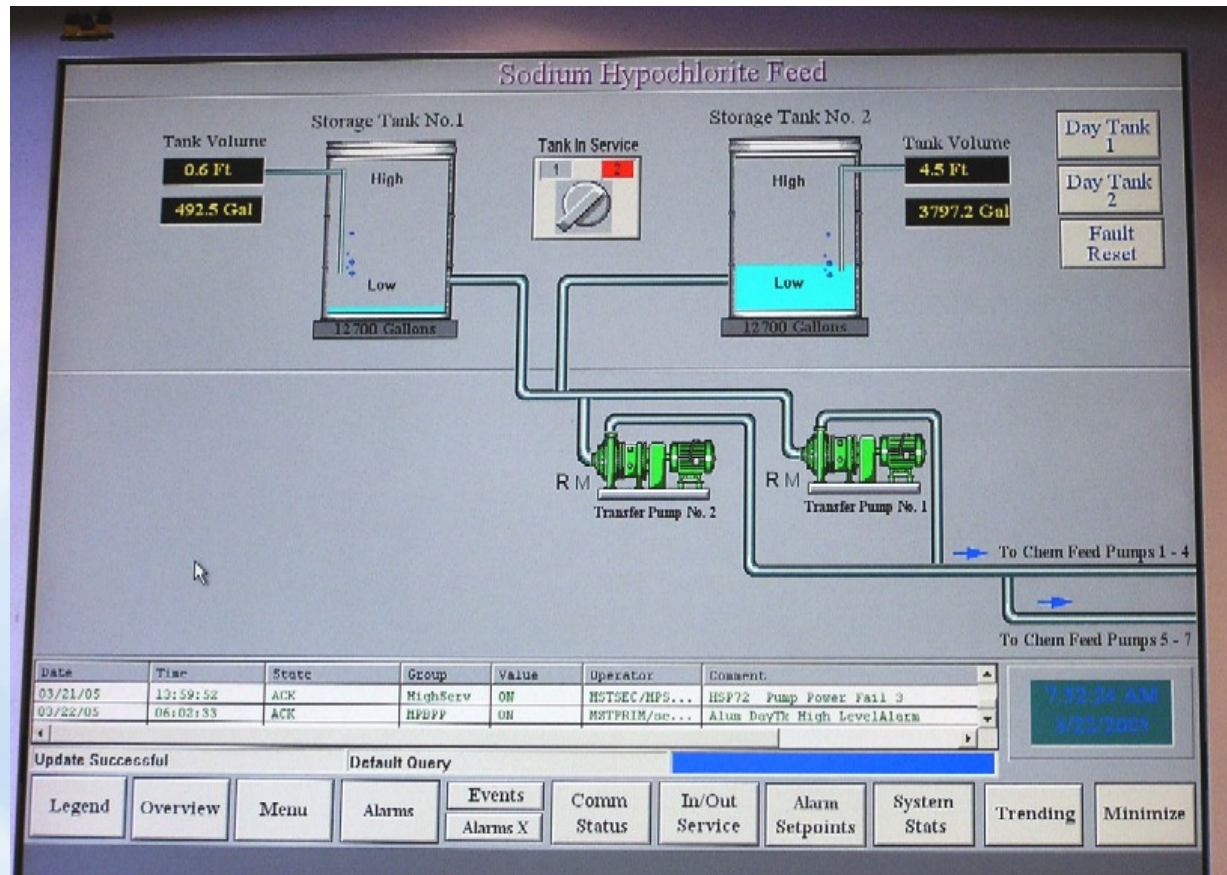
Chemical off loading stations



Lessons Learned

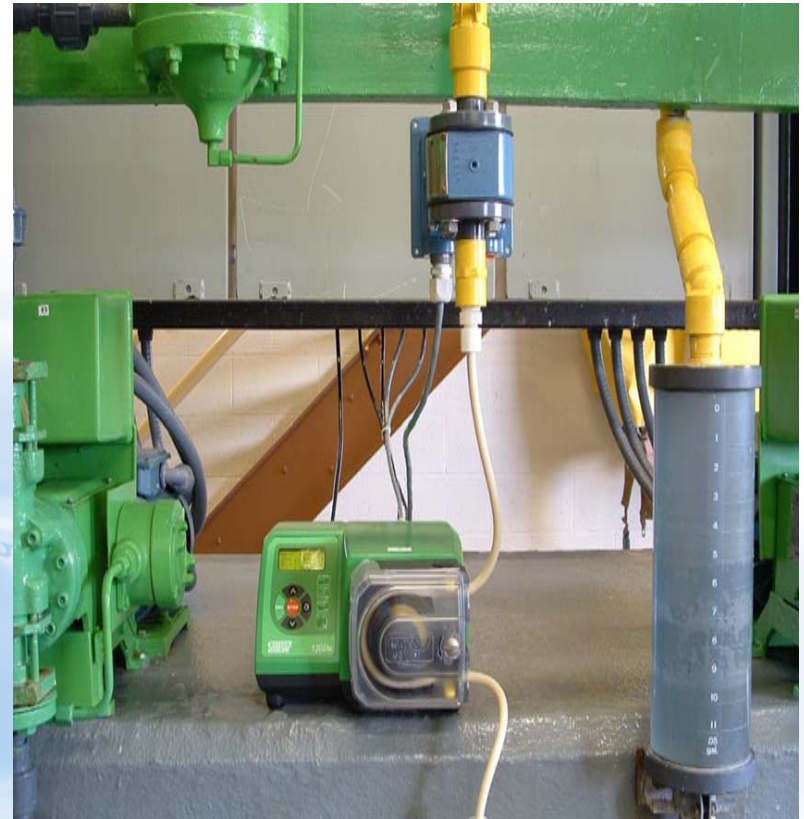
- 💧 Eliminate threaded joints
- 💧 Use of Teflon tape & thread compound
- 💧 Viton Gaskets
- 💧 Maintain inventory-valves, seals, & PVC pipe
- 💧 Stainless hardware
- 💧 Installed off loading sampling station
- 💧 Label valves-open/close, valve keys

Lessons Learned



Improved Monitoring

Lessons Learned



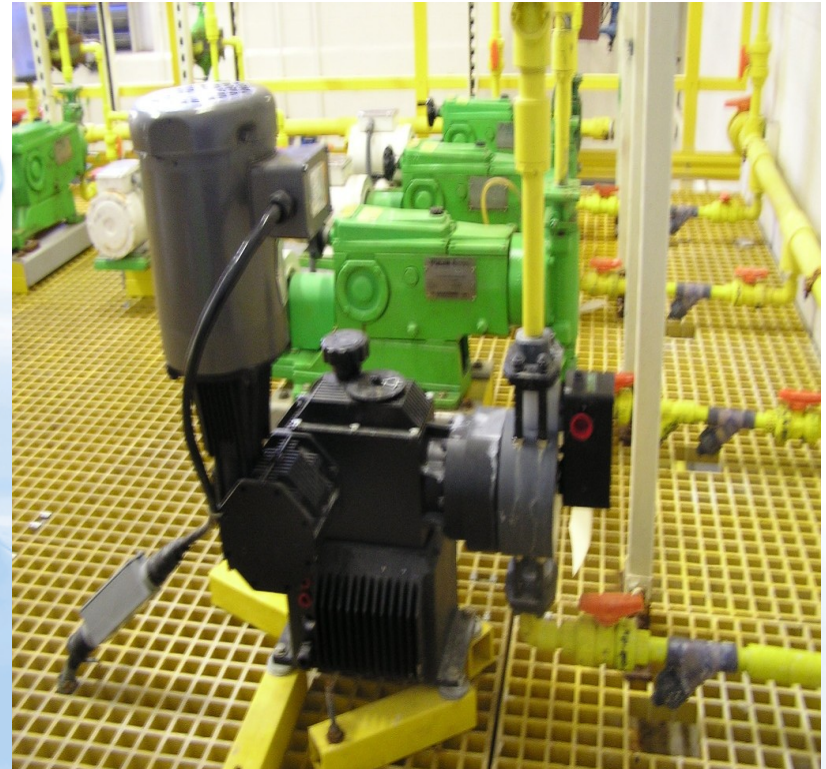
💧 Repositioned chemical meters

Lessons Learned

- 💧 Treated carrier water-phosphate
- 💧 Flush chemical feed lines on a regular basis
- 💧 Flush out unused pumps
- 💧 Treat to avoid CaCl buildup in bulk storage tanks



Future Considerations



- 💧 Peristaltic pumps
- 💧 Beta testing of diaphragm pump with new pump head design

Acknowledgements

Holland Water Treatment Plant Staff

Muskegon Water Treatment Plant Staff